

Citation:

Djousse L, Gaziano JM, Buring JE, Lee I. Egg Consumption and Risk fo Type 2 Diabetes in Men and Women. *Diabetes Care* 2009;32:295-300.

PubMed ID: [19017774](#)

Study Design:

Prospective Cohort study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the association between egg consumption and incident type 2 diabetes among men and women who participated in two large completed reandomized control trials.

Inclusion Criteria:

Participants in the Physician's Health Study (PHS) and Women's Health Study (WHS)

Exclusion Criteria:

Men with prevalent type 2 diabetes

Men with missing data on egg consumption

Men with missing data on potential confounders (smoking, alcohol intake, BMI, exercise, hypertension, and fruit and vegetable intake).

Women with prevalent type 2 diabetes

Women with missing data on egg consumption

Women with missing data on potential confounders (BMI, exercise, Smoking, energy intake, fruit and vegetable intake, nutrients, alcohol consumption, and hypertension).

Description of Study Protocol:

Recruitment: Subjects were not recruited specifically for this study, they were participants in the Physician's Health Study (PHS) and the Women's Health Study (WHS). Recruitment methods for participants in those studies was not discussed.

Design: Information on egg consumption in the past year from the PHS and WHS was self-reported. For men (PHS) the information was obtained using a semiquantitative food-frequency questionnaire at baseline and at 24, 48, 72, 96, and 120 months. Possible responses included rarely/never, 1-3/month, 1 per week, 2-4 per week, 5-6 per week, daily, and 2+ daily.

For women (WHS) the information was self-reported using a 131-item validated food-frequency questionnaire at baseline. Possible responses included never or <1 per month, 1-3 per month, 1 per week, 2-4 per week, 5-6 per week, 1 per day, 2-3 per day, 4-5 per day, and 6+ per day.

Each subject was classified according to the following categories of egg consumption: 0, <1, 2-4, 5-6, and ≥ 7 .

Type 2 DM was ascertained by self-report on annual follow-up questionnaires for both men and women. Self-reporting was deemed appropriate for men, who were all physicians. Among participants in the WHS, self-reporting was validated using telephone interviews, supplemental questionnaires, or review of medical records.

Demographic data collected at baseline included prevalence of hypertension, hypercholesterolemia, family history of DM (WHS only), smoking, exercise, and alcohol consumption.

Blinding used (if applicable): NA

Intervention (if applicable): NA

Statistical Analysis: Within each egg consumption group, the incidence rate of type 2 diabetes was calculated by dividing the number of cases by the corresponding person-time. Cox proportional hazard models were used to compute multivariable adjusted hazard ratios with corresponding 95% confidence intervals. The multivariable model controlled for a number of factors such as age, BMI, smoking, alcohol intake, and others. In women the multivariate model was adjusted for dietary factors that included intake of fruits and vegetables, red meat consumption, intake of polyunsaturated fats, saturated fats, and trans fats.

Data Collection Summary:

Timing of Measurements: Mean follow up for the PHS was 20 years and for the WHS was 11.7 years. In men, data was collected at 24, 48, 72, 96, and 120 months after participants were randomized.

Dependent Variables

- Incidence of type 2 DM as measured by self-reporting (men) and self-reporting with validation (women).

Independent Variables

- Weekly egg consumption as measured by self-reporting

Description of Actual Data Sample:

Initial N: Exclusion criteria were applied to the participants in the PHS (22,071 men) and WHS (39,876 women), resulting in initial n of 20,703 men and 36,295 women for this prospective study.

Attrition (final N): Data was analyzed for all participants; there was no attrition.

Age: Mean age of the men was 53.5 ± 9.4 (ranging from 39.7 years to 85.9 years at baseline) and 54.5 ± 7 years for women (ranging from 38.7-89.9 at baseline).

Ethnicity: Data was not reported but it was mentioned that 90% of participants were Caucasians.

Other relevant demographics: PHS study were all physicians. WHS participants were all female health professionals. Other demographic information was collected at baseline but was not reported.

Anthropometrics: Height and weight were obtained and BMI was reported for various quintiles of egg intake

Location: Not specified.

Summary of Results:

Key Findings

- During mean follow-up of 20.0 yrs in men and 11.7 yrs in women, 1,921 men and 2,112 women developed T2D.
- Among egg consumers, the median egg consumption was approximately one per week in men and women.
- Egg consumption of up to one egg per week was not associated with an increased risk of type 2 diabetes in either sex in multivariate analysis
- Egg consumption greater than 1 egg per week was associated with an increased risk of type 2 DM
- Compared with subjects who did not report egg consumption, intake of seven or more eggs per week was associated with a 58% increased risk of type 2 DM in men and a 77% increased risk of type 2 DM in women after adjustments for potential confounders.
- Compared with no egg consumption, multivariable adjusted hazard ratios (HRs) for T2D were 1.09 (95% CI: 0.87, 1.37), 1.09 (0.88, 1.34), 1.18 (0.95, 1.45), 1.46 (1.14, 1.86), and 1.58 (1.25, 2.01) for consumption of <1, 1, 2-4, 5-6, and ≥ 7 eggs/wk, respectively, in men (P for trend < 0.0001). Corresponding multivariable HRs for women were 1.06 (95% CI: 0.92, 1.22), 0.97 (0.83, 1.12), 1.19 (1.03, 1.38), 1.18 (0.88, 1.58), and 1.77 (1.28, 2.43), respectively (P for trend < 0.0001).

Author Conclusion:

The authors conclude that daily consumption of at least one egg is associated with an increased risk of type 2 diabetes in both men and women, independently of traditional risk factors for type 2 diabetes and that the association between egg consumption and incident type 2 diabetes was not modified by prevalent hypercholesterolemia in either sex.

Reviewer Comments:

Information on egg consumption was self-reported, making it susceptible to reporting error.

Heavy consumers of eggs may also tend to be heavy consumers of other high-fat, high cholesterol foods, which could be a contributing factor for the increased cases of DM in heavy egg consumers. For men, there was limited data available on other dietary factors which could have contributed to DM.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

- | | | |
|----|---|-----|
| 1. | Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies) | Yes |
| 2. | Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about? | Yes |
| 3. | Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice? | Yes |
| 4. | Is the intervention or procedure feasible? (NA for some epidemiological studies) | Yes |

Validity Questions

- | | | |
|------|---|-----|
| 1. | Was the research question clearly stated? | Yes |
| 1.1. | Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified? | Yes |
| 1.2. | Was (were) the outcome(s) [dependent variable(s)] clearly indicated? | Yes |
| 1.3. | Were the target population and setting specified? | Yes |
| 2. | Was the selection of study subjects/patients free from bias? | Yes |
| 2.1. | Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? | Yes |
| 2.2. | Were criteria applied equally to all study groups? | Yes |
| 2.3. | Were health, demographics, and other characteristics of subjects described? | Yes |
| 2.4. | Were the subjects/patients a representative sample of the relevant population? | Yes |
| 3. | Were study groups comparable? | ??? |
| 3.1. | Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT) | N/A |
| 3.2. | Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? | ??? |
| 3.3. | Were concurrent controls used? (Concurrent preferred over historical controls.) | N/A |

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	N/A
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	No
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	No
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	No
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	No
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	???
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	???
7.5.	Was the measurement of effect at an appropriate level of precision?	???
7.6.	Were other factors accounted for (measured) that could affect outcomes?	No
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

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